



First record of the Kermadec Clingfish, *Flexor incus* Conway, Stewart & Summers, 2018 (Gobiesocidae), from New Caledonia and Australia

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Abstract

Two specimens (17.1 and 29.1 mm standard length) of *Flexor incus* Conway, Stewart & Summers, 2018 (Gobiesocidae) were collected from New Caledonia and Lord Howe Island, Australia. The species and genus were originally described on the basis of 15 specimens from the Kermadec Islands, New Zealand, where the genus has been considered endemic. The two specimens reported herein represent the first records of *F. incus* from New Caledonia and Australia.

Keywords

Diademichthyinae, geographic distribution, Pacific Ocean, range extension, Tasman Sea

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Introduction

The family Gobiesocidae is a moderate-sized fish family, commonly called clingfishes because all members of the family, except for the shore eel genus *Alabes* Cloquet, 1816, have a well-developed ventral adhesive disk with which they adhere tightly to the substrate (Briggs 1955; Conway et al. 2020). Most members of the family inhabit intertidal and subtidal zones in the Atlantic and Indo-Pacific oceans, and a small number of species occur in deeper waters down to 570 m or in freshwater streams in the neotropics (Briggs 1955; Conway et al. 2017a; Hastings and Conway 2017). Currently, the family contains 185 valid species of 51 genera (Fricke et al.

2021). However, taxonomic study on the family continues to result in the description of new taxa (four new genera and 22 new species have been described since 2015) (Fricke et al. 2021).

As part of an ongoing taxonomic study of the Gobiesocidae, we examined unidentified material from New Caledonia and Australia (Lord Howe Island) held in the ichthyology collections of the National Museum of Natural History (Washington, DC) and the Australian Museum (Sydney), respectively. Subsequently, these specimens were identified as *Flexor incus* Conway, Stewart & Summers, 2018, originally described as a new

genus and species on the basis of 15 specimens from the Kermadec Islands, New Zealand. Because additional specimens of the species have not been recorded until now, the present specimens, reported in this study, represent a significant distribution range extension for *F. incus* into the southwestern Pacific Ocean. Comparative comments on *Flexor* and the similar, potentially closely related genera *Pherallodus* and *Propherallodus* are also provided.

Methods

Counts and measurements followed Conway et al. (2018a). Measurements are expressed as a percentage of standard length (SL) or head length (HL), respectively. Disc terminology follows Briggs (1955: fig. 1). Head sensory pore terminology follows Shiogaki and Dotsu (1983: fig. 1) and Conway et al. (2017b: fig. 1). Those regions were observed using versatile staining with Cyanine Blue (Saruwatari et al. 1997). The distributional map was prepared using GMT 5.3.1, with data from GSHHG (Wessel and Smith 1996). Institutional codes followed Sabaj (2020).

Comparative material examined. *Flexor incus*: holotype and 14 paratypes, 14.0–27.2 mm SL, listed in Conway et al. (2018a). *Pherallodus indicus* (Weber, 1913): CMNH-ZF 11050, 19.5 mm SL, KAUM-I. 20722, 26.2 mm SL, Boso Peninsula, Chiba, Japan; KAUM-I. 40072, 14.3 mm SL, Yoron Island, Amami Islands, Ryukyu Islands, Japan. *Propherallodus smithi* (Briggs, 1955): CAS 131349, holotype, 18.5 mm SL, Durban, South Africa.

Results

New records (Fig. 1). NEW CALEDONIA – Loyalty Islands • north of Wenyook Island; 20°26'06"S, 166°28'30"E; 0.6–3.6 m depth; 17. XI. 1991; J. Williams and M. Kulbicki; USNM 322448, 29.1 mm SL.

AUSTRALIA – New South Wales • Lord Howe Island, North Head; 31°32'S, 159°04'E; D. Hoese; AMS I. 17424-003, 20.8 mm SL.

Identification. Morphometrics data on the two specimens from New Caledonia and Australia (Fig. 2) are provided in Table 1. The present specimens agree closely with Conway et al. (2018a), the original description of *F. incus*, in having the following characters: 9 or 10 dorsal-fin rays; 9 anal-fin rays (except for USNM 322448); 24 pectoral-fin rays (except for AMS I. 17424-003); upper-jaw teeth incisiform, compressed laterally, with hook-like tips strongly curved posteriorly (ca. 90°), except for symphysis with 2 or 3 slightly curved conical teeth; lower-jaw teeth with pointed conical tips, inner surface slightly curved; small oval opening between premaxillae present; head sensory canal pores well developed, including 2 nasal, 2 lacrimal, 2 postorbital, and 3 preopercular pores; mandibular pores absent; gill membranes free from isthmus; pelvic fins and pectoral-girdle

elements forming a circular, “double” adhesive disc; disc regions A, B, and C with flattened papillae (damaged in AMS I. 17424-003), anterior part of disc region A with 3 rows of papillae across center, disc region B with 4 rows of papillae, and disc region D without papillae (Fig. 3).

Counts of anal- and pectoral-fin rays differ slightly between the specimens presented herein and those of the type series [7 anal-fin rays (USNM 322448) and 22 pectoral-fin rays (AMS I. 17424-003) vs. 8 or 9 and 24 or 25, respectively in the original description]. However, these differences are regarded here as intraspecific variations of *F. incus* as similar variations have been reported

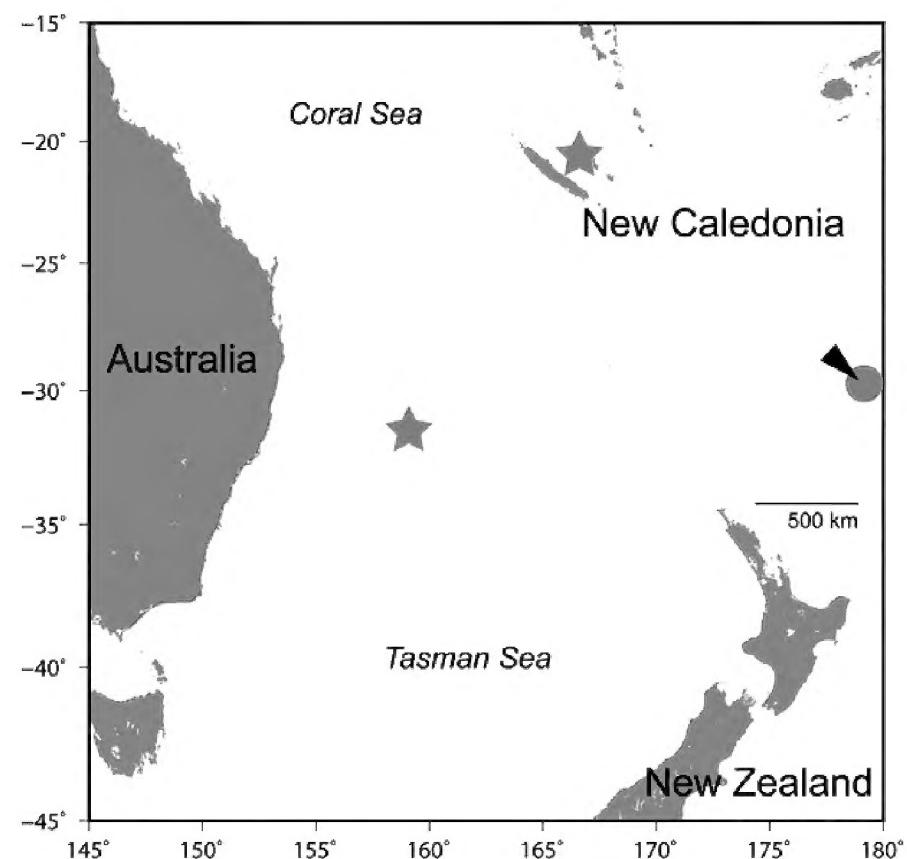


Figure 1. Distribution records of *Flexor incus*. Stars and circle indicate new and previous records, respectively. Arrowhead indicates type locality.

Table 1. Morphometric measurements of *Flexor incus* from New Caledonia (USNM 322448), Australia (AMS I. 17424-003) and New Zealand (Conway et al., 2018a; $n = 7$).

	USNM 322448	AMS I. 17424-003	Conway et al. 2018a
Standard length (mm; SL)	29.1	20.8	16.9–27.2
In % of SL			
Head length (HL)	31.0	28.7	29.4–34.5
Body depth	15.3	14.6	10.0–14.9
Predorsal length	75.4	69.6	73.3–82.2
Preanal length	74.2	69.6	72.6–77.7
Preanus length	57.9	57.3	60.7–63.0
Anus to disc	15.6	19.9	14.1–18.6
Anus to anal fin	13.7	12.3	8.0–9.7
Caudal-peduncle length	10.3	8.8	8.0–10.1
Caudal-peduncle depth	10.7	9.9	8.2–11.1
Disc length	19.2	17.0	17.8–26.0
Disc width	15.9	15.8	16.3–20.1
In % of HL			
Head depth at orbit	30.9	39.8	25.9–34.8
Head width at orbit	48.7	49.0	42.6–51.9
Head width at widest point	60.2	69.4	52.9–67.3
Interorbital width	22.3	26.0	19.5–23.1
Snout length	30.6	26.5	28.1–36.5
Eye diameter	22.1	22.4	17.2–22.2

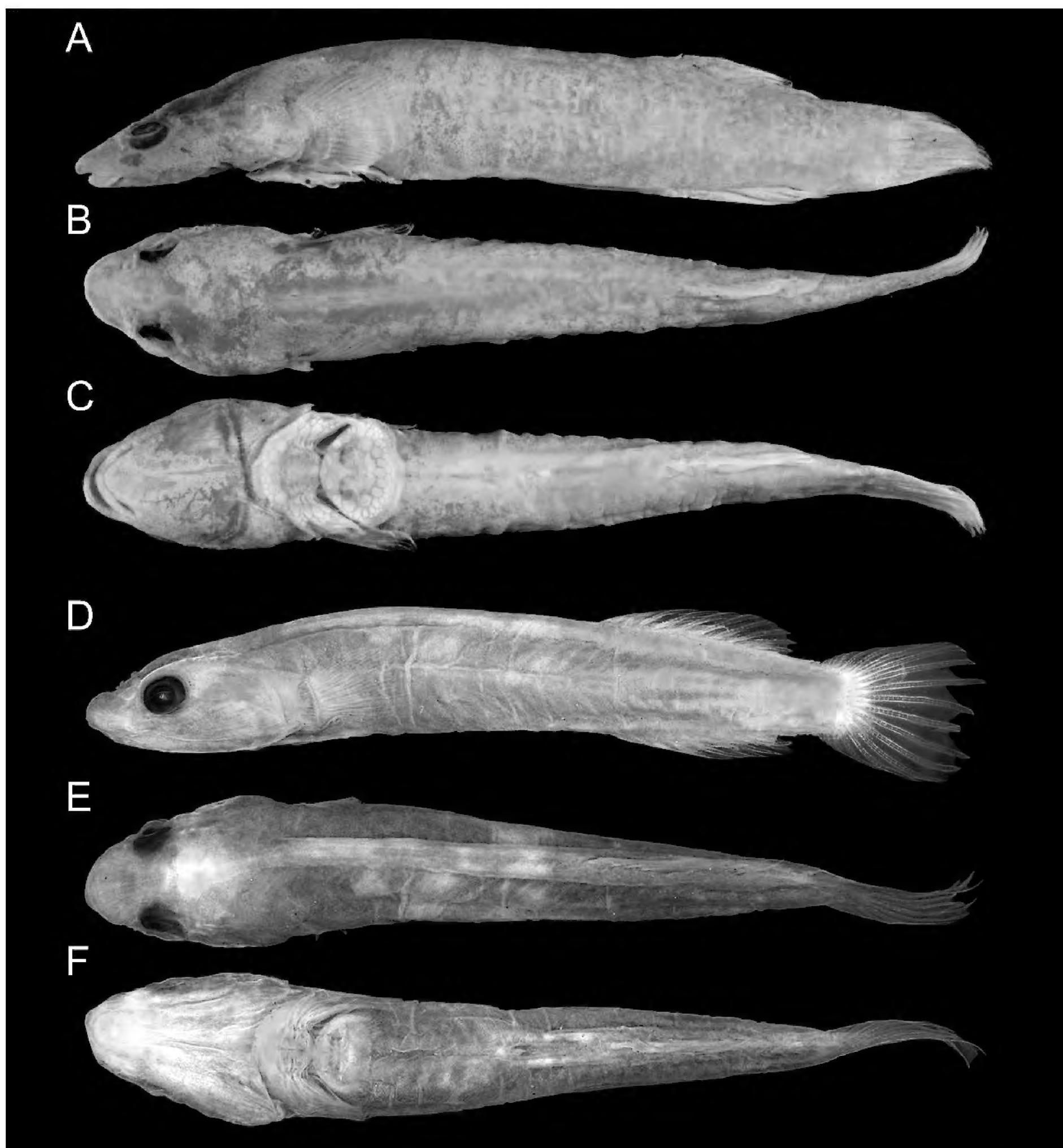


Figure 2. Preserved specimens of *Flexor incus*. **A–C.** USNM 322448, 29.1 mm SL, north of Wenyook Island, Loyalty Islands, New Caledonia. **D–F.** AMS I. 17424-003, 17.1 mm SL, North Head, Lord Howe Island, New South Wales, Australia. **A, D.** Lateral views. **B, E.** Dorsal view. **C, F.** Ventral view.

in other gobiesocid genera (e.g., *Aspasma ubaou* Fujiwara and Motomura 2019). In addition, Conway et al. (2018a) described 2 or 3 rows of papillae on disc region C whereas only a single row of papillae was confirmed in USNM 322448 (Fig. 3). This discrepancy may be related to papillae loss, which can occur easily during collection leaving no trace (Fujiwara and Motomura 2018a).

Discussion

Flexor incus was described as a new genus and species on the basis of 15 specimens from the Kermadec Islands

of New Zealand. In the original description (Conway et al. 2018a), *F. incus* was reported from only two islands within the Kermadec archipelago, including Raoul Island (type locality) and L'Esperance Rock, and no additional records of the species have been reported until now. The specimens reported herein, collected from Loyalty Islands and Lord Howe Island, represent the first records of *F. incus* from New Caledonia and Australia, respectively. This suggests that the species possibly has a wider distribution in the southwestern Pacific Ocean and Tasman Sea (Fig. 1). Interestingly, except for the deep-water clingfish *Kopua nuimata* Hardy, 1984, all tidal and subtidal species of clingfishes inhabiting the

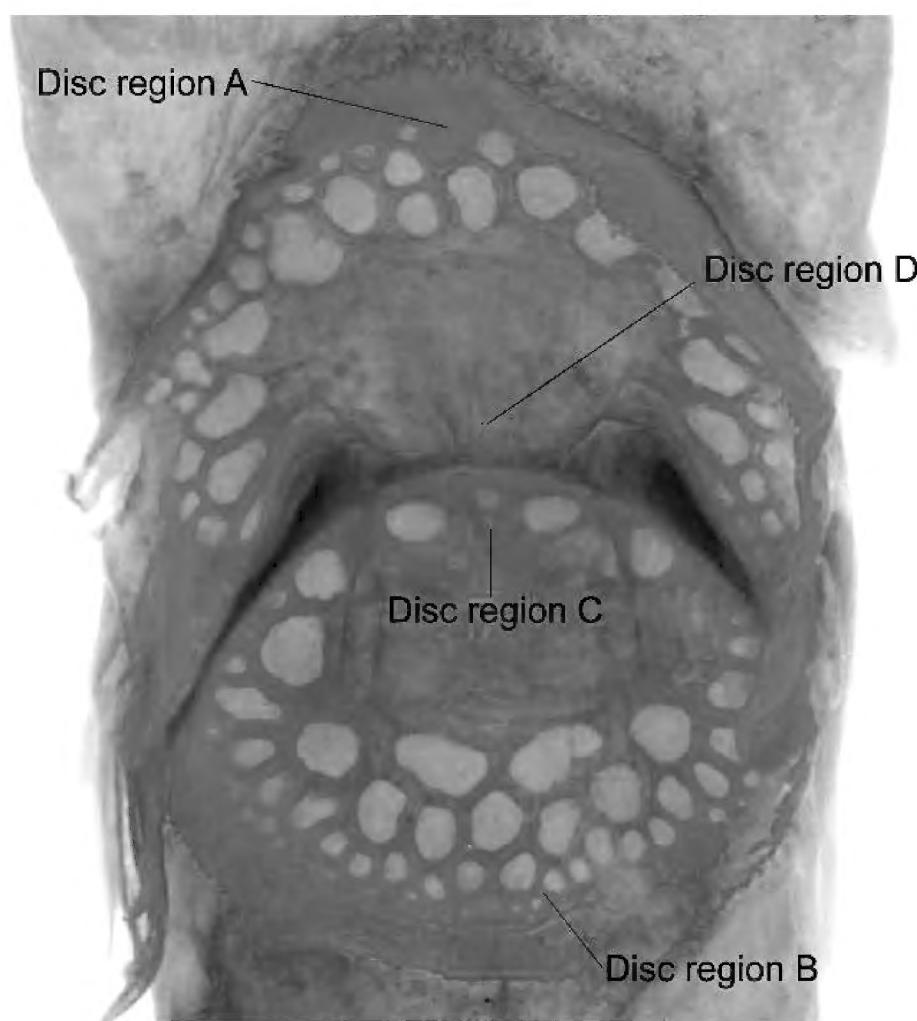


Figure 3. Ventral adhesive disc (cyanine stained) of *Flexor incus*, USNM 322448, 29.1 mm SL.

main islands of New Zealand (12 species representing 8 genera) are endemic to this region (Stewart 2015; Conway et al. 2017b, 2018b; Fujiwara and Motomura 2020). Although the Kermadec Islands are included in New Zealand waters, these islands are located far from the relatively well-surveyed main islands and it is unlikely that *F. incus* is present beyond the Kermadec Islands in New Zealand waters.

In their original description of *F. incus*, Conway et al. (2018a) pointed out that the higher classification of clingfishes proposed by Briggs (1955) may require revision. More recently, the classification scheme of Briggs (1955) was revised by Conway et al. (2020), who recognized nine subfamilies in the Gobiesocidae based on the results of a molecular phylogenetic investigation. According to them, the monotypic genus *Flexor* is assigned to the subfamily Diademichthyinae, which they expanded to include several additional genera formerly included in the Aspasminae, Diplocrepinae, and Protagobiesocinae by Briggs (1955) and Fricke et al. (2016). Although *Flexor* was recovered as the sister taxon to *Aspasmichthys ciconiae* (Jordan & Fowler, 1902) in Conway et al.'s (2020) study, the former is superficially similar to *Pherallodus* Briggs 1955 [including *Pherallodus indicus* (Weber, 1913)] and *Propherallodus* Shiogaki & Dotsu 1983 [including *Propherallodus briggsi* Shiogaki & Dotsu, 1983, *Propherallodus longipterus* Fujiwara & Motomura, 2018b, and *Propherallodus smithi* (Briggs, 1955)]. These three genera can be distinguished from other members of the Diademichthyinae sensu Conway et al. (2020) in having a “double” adhesive disc (sensu Briggs 1955) and gill membranes free from the isthmus. *Flexor* differs from *Pherallodus* and *Propherallodus* by the teeth shape in both jaws, disc papillae (also

see below), and head sensory canal pores (see Conway et al. 2018a: 95). Papillae are present across the center of region A and C in *Flexor* (Fig. 3; Conway et al. 2018a: fig. 9A) whereas papillae are said to be absent from the center of both region A and C in *Pherallodus* (Shiogaki and Dotsu 1983). Examination of specimens of *Pherallodus indicus* in this study confirmed the absence of papillae from the center of region A as described by Shiogaki and Dotsu (1983) but papillae are present at the center of region C, as in *Flexor*. Compared with *Pherallodus* and *Propherallodus*, *Flexor* exhibits fewer rows of papillae on disc region B [4 or 5 rows in *Flexor* (Fig. 3; Conway et al. (2018a) vs. 5–7 (usually 6) in *Pherallodus* and *Propherallodus* (Shiogaki and Dotsu 1983; Fujiwara and Motomura 2018b; this study)].

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